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ABSTRACT

The purpose of this experiment was to determine if subjects who were unaware that a phrase has been deleted from a sentence could match the deleted phrase in both semantic content and syntactic position. Subjects were required to complete one of two blanks in a sentence with a prepositional phrase. Instructions stressed that these completions should result in natural sounding sentences. The semantic values of the prepositional phrases were scored on the basis of 54 semantic categories. There appeared to be distinct semantic-syntactic categories of restrictions on the modification of nouns and verbs by prepositional phrases. Furthermore, the availabilities of these restrictions differed systematically. (WR)

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Decision and Modification in Sequences of Prepositional Phrases

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When a phrase has been deleted from a sentence, might Subjects unaware of this fact elaborate upon the sentence and, in their elaboration, match the deleted phrase in both semantic content and syntactic position? Most people would agree to this possibility, but, though such detection of deleted material appears certain, few have sought to investigate its importance to constructing a psychologically relevant grammar. The importance lies in the nature of constraints upon linguistic modification and the availability of these constraints to the listener.

In the present experiment, the materials consisted of fifty-one sentences each containing a sequence of two prepositional phrases. Since the syntactic ordering of the phrases is of interest, the most natural and best sounding ordering of the prepositional phrases in each sentence was previously established experimentally and cross-validated. Since the question is one of detecting deleted phrases from sentences, Subjects do not see these original sentences but are asked to elaborate upon versions of them.

The present experiment utilizes the between Subject task design illustrated by example for the original sentence, "Gretchen opened the box in the shed with a screwdriver":

A. Gretchen opened the box _____with a screwdriver_____.

B. Gretchen opened the box _____in the shed_____.

One of the phrases from the original sentence is deleted and blanks are placed on either side of the remaining prepositional phrase.

The Subjects' task is to complete one and only one of the two blanks with a prepositional phrase. Instructions stress that these completions should result in natural sounding sentences. The question is, then, twofold: First, whether the semantic value of the prepositional phrase completion provided by the Subject corresponds to the semantic value of the deleted prepositional phrase. Second, whether the position of the prepositional phrase completion corresponds to the position of the deleted prepositional phrase.

The semantic values of the prepositional phrases were scored on the basis of 54 semantic categories. By-in-large the semantic value of a prepositional phrase corresponds to the preposition which heads it. But in certain instances prepositional usages of a given preposition are further distinguished. Time and location information is consistently distinguished from other categories, and a prepositional phrase headed by the preposition by, for instance, is distinguished four ways in accordance with the demands of Case grammars. An agreement in semantic value between a given prepositional phrase deletion and a given prepositional phrase completion is scored if the prepositional usage in the deletion matches the prepositional usage in the completion.

The results are displayed in Table 1. In order to estimate the probabilities of semantic detection that one expects by chance, response bias was estimated from the response frequency distributions

to each semantic category. With twelve Subjects responding to each deleted phrase condition, we are able to reject the hypothesis that semantic detection occurs at chance levels of responding with a confidence criterion of .001 (by Sign tests).

Of concern in the syntactic (or phrase position) analysis is not the semantic values of the completions but their positions in the sentences. Again response bias estimated chance performance. The first blank of the two blanks is generally more often responded to. But deletions to either blank are detected more often than one expects by chance. Again, the alpha criterion is .001 (by Sign tests).

Also visible in Table 1. is a significant tendency for detection, both semantic and syntactic, to occur more often to deletions of the first prepositional phrase than to deletions of the second prepositional phrase. In general, there are more semantic possibilities of different completions of the second blank than the first blank, but the first blank is generally more often responded to. A Case grammar has properties which are useful in describing the problem of how these effects could occur.

But before we can adopt this approach, it is necessary to confirm that such a Case approach is applicable to our data. Two points are made: First, that the completions do not repeat the prepositional phrases in the to be completed sentences. In other words, that the semantic categories are mutually exclusive

within each sentence. Second, that semantic value and syntactic position are closely bound in the completions.

A rough measure of whether the prepositional usages selected for analysis correspond to Cases lies in the traditional notion that the same Case should never appear twice in the same clause. That is, Cases are semantically distinct. This hypothesis regarding the usages selected for study is significantly supported with such repetition occuring only nine times in the 1224 completions. In these nine repetitions, the completion invariably modifies a different word than the prepositional phrase already provided.

In order to estimate the degree of association between semantic value and syntactic position, we looked only to those responses which agreed semantically with the deleted phrases and asked whether they also agreed syntactically. The results of this analysis are seen in Table 2. The association between semantic value and syntactic position is quite strong as evidenced by a Chi Square value of about 140 at one degree of freedom.

The groundwork is laid for a Case approach of the sort which Robinson (1969) describes. Central to such an approach is that a noun or a verb may be sensibly modified by some prepositional phrases but not by others. This potential for modification is typically given by a set of Case restrictions for every noun or verb which can be modified by prepositional phrases. The crutial assumption, psychologically, concerns the availability of these

restrictions to a person in the absence of the modifying phrases. From such analysis, it follows that Subjects will demonstrate both an ability to detect the missing phrase and an ability to detect the position of that missing phrase in the sentence. However, what this analysis ignores is the possibility of other Case restrictions which are not realized in the original sentences by prepositional phrases.

Generally, in linguistics, such problems as these are solved in noting that in a given context some prepositional phrases are mandatory while others may be optional. But as Labov points out, such a descrete distinction is less true to the facts than a continuous one. This suggests that a Case restriction is more or less available to the Subject when he seeks to elaborate upon the sentence. If we assume that the first prepositional phrase is a surface manifestation of a highly available Case restriction, while the second prepositional phrase is a surface manifestation of a less available Case restriction, then it is clear that the results of the completion task are expected. The absence of the first prepositional phrase stands out more prominently from other possible responses than the absence of the second prepositional phrase.

The notion that different Case restrictions in a given context may vary in their availability to the Subject may be brought to direct experimental test. Semantic restrictions on complementing

words and phrases are noted in the psycholinguistic literature in their disambiguating function and in their function with relation to inquiry, especially grammatically determined inquiry where, say, the listener fails to pick up a word from a sentence and inquires of the speaker as to the word he missed. If some restrictions are more available from the comprehension of a sentence, it follows that one sentence may result in question raising while another might not. This forms the basis of a second experiment. The semantic and syntactic analyses suggest that Case restrictions corresponding to the deleted first prepositional phrase are more available than Case restrictions corresponding to the deleted second prepositional phrase. This suggests that sentences where the first prepositional phrase is deleted should have a stronger requirement to raise questions about the content of the sentences.

Question raising of this type is typically employed in comprehensibility tasks. Although in these tasks Subjects are given other criteria and are constrained to make their judgements in a short period of time (typically less than 5 seconds). In the present experiment, question raising is employed alone, as a single criteria, and Subjects are allowed an indefinite amount of time to make their judgements. Subjects are instructed to choose the form of the original sentences, where one or the other of the prepositional phrases has been deleted, which has

the stronger requirement that some question be raised about the sentence's content. They are further instructed to rate their confidence in this response on a 1 to 3 point rating scale, with 1 indicating least confidence and 3 greatest confidence.

The results of the rated completeness task confirm the prediction. Sentences deleting the first prepositional phrase are rated as less complete than sentences deleting the second prepositional phrase. This difference is significant by a one tailed t-test at the .001 alpha level ($t=3.84$; $df=50$).

But of the 51 sentences, 19 were assigned ratings which, on the average, contradicted the prediction. The sentence by sentence analysis revealed, interestingly, that these included sentences containing a second prepositional phrase in the instrumental case (as in the example given above) and also sentences containing a second prepositional phrase in the agentive case (as in "The decision was read to the committee by the Judge.") This suggests some systematic deviation from the hypothesis that the Case restrictions for the first prepositional phrase are more available than the Case restrictions for the second prepositional phrase under conditions in which these phrases have been deleted.

In summary, there appear to be distinct semantic--syntactic categories of restrictions on the modification of nouns and verbs by prepositional phrases. Furthermore, the availabilities of these

restrictions differ systematically. We are presently concerned with extending the present findings, especially with regard to possibly constancies, i.e., one semantic category being typically more available than another, and the effects of context in changing availabilities. But these concepts are also useful in describing decision in the modification of sequences of prepositional phrases. For instance, how do we know that in the sentence, "Arnold went to the beach on the bus." , the second prepositional phrase modifies the verb went, while in the sentence, "Arnold went to the beach near the lighthouse.", the second prepositional phrase modifies the noun beach? The present argument suggests that it is something about the meaning (or lexical properties) of 'went' and 'beach' which allow these interpretations to be made.

References

Robinson, J. Case, category and configuration. Journal of Linguistics, 1969, 6, 57-80.

Table 1

Results of the Completion Task

Percent Match	Deleted Phrase	
	First	Second
Semantic Count (prepositional usage given by Subject matches that of deleted phrase)	42%	18%
Syntactic Count (position of phrase given by Subject matches the position of the deleted phrase)	75%	66%

Table 2

Association between Semantic and Syntactic Detection

Frequency of Semantic Matches	Position of Response	
	First Blank	Second Blank
First Phrase Deleted	230	30
Second Phrase Deleted	30	81